US Army Corps of Engineers
Portland District

EPA

Mouth of the Columbia River Dredged Material Disposal Site Annual Use Plan for 2004

1. Background

The mouth of the Columbia River (MCR) is the ocean gateway for maritime navigation to/from the Columbia – Snake River navigation system. The U. S. Army Corps of Engineers is responsible for the operation and maintenance (O&M) of the federal deep-draft navigation channel at the Mouth of the Columbia River (MCR). The MCR navigation channel lies within Columbia River mile –3 to +3. The federal navigation project at the MCR is authorized by Rivers and Harbors Act of 1884, 1905, 1954, and Public Law 98-63. The authorized project provides for a 2640-ft wide deep-draft navigation channel across the Columbia River bar. The northerly 2,000 ft of the channel is maintained at –55 ft MLLW (plus 5 ft for over dredging), and the southerly 640 ft of the channel is maintained at –48 ft MLLW (plus 5 ft for over dredging). Each year, the Corps of Engineers-Portland District dredges 3-5 million cubic yards (MCY) of sand at MCR to maintain the 6-mile long deep draft navigation channel. Most of the dredging occurs between river mile –2 and +2. The dredged material is fine-medium sand (0.17-0.27 mm) and fine-grained material content is less than 4%.

Maintenance of the MCR project includes disposal of dredged material. The dredged sand is placed at ocean dredged material disposal sites (ODMDS) or at sites permitted through Section 404 of the Clean Water Act (404 site). MCR open water dredged material disposal sites available for 2004 are shown in figure 1 (denoted in red) and 1a. Management of an open water disposal site is predicated on the need to efficiently utilize the site's capacity while minimizing impacts to navigation and offsite environment, and meet statutory requirements. The capacity of a dredged material disposal site is the volume (or height and area) of dredged material that can accumulate within a site's boundaries without unacceptable adverse impacts to navigation or the environment. The potential effect of dredged material accumulation upon waves (mound-induced wave shoaling) is an important consideration at MCR [USACE 2003 and 2004].

2004 Dredging Year. In consideration of stakeholders concerns, USACE and EPA have assigned a target capacity for each disposal site to be used during the 2004 dredging season. General utilization procedures and governing constraints for each disposal site and hopper dredge operation are described in Appendix A.

Due to the exposed ocean conditions at MCR, only ocean-going hopper dredges can perform dredging and disposal at MCR; dredging is limited to summer when wave conditions are favorable for working on the bar. Two hopper dredges are used to perform

maintenance dredging at MCR: A government operated dredge and a contractor operated dredge, each with different capacities and operating characteristics. For 2004, the contract dredge (*Sugar Island*) will begin dredging at MCR within the timeframe of 10-15 June and the government dredge (*Essayons)* will begin MCR dredging on approximately 26-30 June. Recent surveys of the MCR navigation channel indicate that the total O&M dredging requirement for MCR in 2004 could exceed 4 MCY, and dredged material disposal capacity within ODMDS E and NJ Site is less than normally observed. ODMDS E was expanded to its present configuration in 1997, under section 103 of the Marine Protection Research and Sanctuaries Act. For 2004, the total capacity at the three available disposal sites is greater than 8 million cubic yards.

2. Objective

The objective of this *Annual Use Plan* for 2004 is to: A) Provide a decision framework that allows MCR dredging operations managers to manage open water disposal sites on a day to day basis , and B) Define a strategy to collect information (via monitoring or assessment of operational data) on a frequent basis, so that potential problems can be identified and corrective action can be undertaken. The amount of dredged material that can be placed in an open water disposal site is limited by the site's capacity to disperse or accumulate the material without adversely affecting the environment or navigation. The principal site management constraint for MCR is to avoid modification of a disposal site's bathymetry (via dredged material mounding) that could potentially result in excessive wave amplification, due to wave shoaling over mounded dredged material. This AUP meets the requirement of the MCR ODMDS site management & monitoring plan.

As proposed, this *Annual Use Plan* is in place for the 2004 dredging season only. Elements of this annual use plan can be changed during the dredging season in accordance with adaptive site management. A final site management and monitoring plan for MCR dredged material disposal sites will be developed during EPA's final site designation process [EPA 2003].

The 2004 *annual use plan* describes how each available MCR dredged material disposal site will be used and monitored. Two methods will be employed to monitor the placement of dredged material within each disposal site used during 2004 and prevent mounding beyond the management target. The first monitoring method focuses on tracking the placement of dredged material within each disposal site on a daily basis, by plotting the location of each load placed. Frequent plotting of disposal locations will provide a continuous knowledge base of how placed dredged material is likely being deposited within a given site. During 2003, the daily tracking of hopper dredges (during dredged material disposal) significantly enhanced the management of dredged material disposal site capacity [USACE 2004]. The second monitoring method involves conducting frequent bathymetry surveys at active MCR disposal sites, during the dredging season. Comparison of surveys to a site's baseline condition will quantify deposition of dredged material placed within a given site. Timely use of this information can be used to manage dredged material accumulation within a given disposal site.

The 2004 *annual use plan* is based on adaptive management. This means that MCR disposal sites will be proactively managed: As sites are used, they are monitored to verify that the sites are being managed according to 2004 capacity targets. If a given disposal site is at or near its target capacity, then site management changes accordingly. The *annual use plan* implements various recommendations made by a "*Federal Review Team"* [USACE 2001] which was convened in September 2001 for the purpose of reviewing management practices at MCR dredged material disposal sites.

3. Site Management Criteria

The level to which any site can be used for dredged material disposal is related to the capacity available within the site, and the efficiency to which the site's capacity is used. This means that the dredged material would be placed though out the entire site, both in space and time, using a regimented procedure to produce a uniform continuous layer on the seabed, avoiding the formation of any localized mounding. Geometrically, the target capacity for a given disposal site is defined by the target height and area over which dredged material can accumulate (collectively referred to as a "target accumulation"), with respect to a baseline condition. The target capacity for a given disposal site defines a management condition for which an intermediate review action (decision point) occurs. At this point, the potential affects of additional use of a disposal site are assessed in conjunction with other physical processes. Use of an active disposal area may be discontinued upon reaching the specified target accumulation. The target accumulation is based on the need to manage dredged material accumulation such that mounded dredged material does not excessively amplify waves, due to shoaling and refraction. The target accumulation can be different for each disposal site.

Values for managing the accumulation of dredged material were obtained using the RCPWAVE model [Ebersole 1986] as discussed in USACE [1999, 2001, and 2002]. RCPWAVE is a computer program that simulates the behavior of waves as they interact with variable bathymetry (or in this case, underwater mounds). It must be noted that results obtained using RCPWAVE can be 10-50% higher than the actual case: The RCPWAVE program overestimates how waves interact with variable bathymetry (the model is conservative). The target mound heights given in table 1 are conservative and should provide a safe operational limit to define an intermediate review action for site management.

Table 1 presents the target mound heights applicable for MCR disposal sites and Appendix A discusses site specific details concerning target mound heights, site utilization, and present disposal site capacity. Because of the need to assign capacity and concern for navigation safety, thresholds for increasing the level of monitoring intensity and management responses have been identified. The "target mound height" values shown in table 1 are intended to be used only as an ODMDS management guide (a screening tool to identify site management thresholds for concern). Disposals that accumulate less than or to the "target mound height" throughout the site are not of great concern. (Note: the values shown in Table 1 apply to a mound feature that occupies an

area of 2,000 x 2,000 ft). For smaller mound features that are less than, equal to, or even which marginally exceed the "target mound height" values, little or no wave amplification would be expected [USACE 2002]. Once at or above the "target mound height" greater management attention as to how material is placed to create a uniform surface would engage.

The target mound height corresponding to the **"present"** site condition (May 2004) is the parameter that applies to the utilization of sites at the beginning of the 2004 dredging-disposal season. This "present" disposal site condition will be redefined based on subsequent site surveys. Note that the bathymetry at several disposal sites has changed since the establishment of the sites' baseline condition. For example, the eastern area of ODMDS E is now deeper than is was in 1997 (baseline condition) while the western area of the site has less depth than in 1997 (see figure 7b). The "present" target mound heights shown in table 1 account for the change in site bathymetry that have occurred since the baseline condition.

Concern should arise only if the level of accumulation significantly exceeds the target height and/or the area of accumulation exceeding the target value becomes greater than 2,000 x 2,000 ft. Examination of wave amplification potential will be conducted only if dredged material accumulates to levels that far exceed the "target mound height" and/or covers an area larger that 2,000 x 2,000 feet. Should this occur, the STWAVE model [Smith 2001] will be used to assess whether the area of accumulation may potentially affect waves in or near the disposal site in question. Although RCPWAVE is considered an appropriate model for establishing conservative target mound heights, STWAVE is more accurate and considered to be more suitable for predicting actual conditions.

Table 1. Target height of dredged material mounds, based on the RCPWAVE model. Values to be used for intermediate review of disposal site capacity.

Disposal Site	Target Mound Height (ft) with respect to Baseline	**Present**	Usable Disposal Site Area(acre)	Present Site Capacity Volume (CY)
Site E – East	5	**6**	190	**1.3 M**
Site E – West	5	**2**	100	**0.3 M**
NJ Site*	8	**3**	100	**260 K**
DW Site - 103	40	**40**	207	**7.5 M +**

Site E = ODMDS E as expanded in 1997 under section 103 of MPRSA
* = The NJ is not subject to the same target mound geometry criteria as unprotected sites. For initial assessment of 2004 dredging-disposal season, capacity of Site NJ has been set at 260 kcy to minimize potential transport to areas near the MCR channel.
Baseline = 1997 for ODMDS E, 1999 for NJ Site, and 2000 for DWS-103

4. Decision Framework for Site Threshold Management

Based on the above site management criteria, there are 6 action levels that will be used for managing dredged material placement within disposal sites at MCR.

Level 1. **Normal Level** = Dredged material accumulation is not close to the accumulation target. ACTION: Proceed as planned.
Level 2. **Limited Capacity Level** = Dredged material accumulates to within 1-2 ft of the threshold mound height. ACTION: Minimize placement in affected location.
Level 3. **Threshold Level** = Dredged material accumulates to (or marginally exceeds) the target mound height within localized extent (less than 500 x 500 ft). ACTION: Assess accumulation in surrounding cells and overall site capacity. Avoid or minimize placement in the affected location of accumulation. Continue to use adjacent areas within site appropriately.
Level 4. **Limited Management Level** = Dredged material exceeds target mound height by 1-2 ft within an area greater than 500 x 500 ft. ACTION: Assess accumulation in surrounding cells and overall site capacity. Avoid or minimize placement in the affected location of accumulation and in adjacent areas. Continue to use areas not affected; adopt early exit strategy for site.
Level 5. **Moderate Management Level** = Dredged material exceeds target mound height by more than 2 ft within an area greater than 1,000 x 1,000 ft. ACTION: Assess accumulation in surrounding cells and overall site capacity. Stop using the area of the site exhibiting accumulation, until natural erosion has reduced accumulation (restored site capacity).
Level 6. **General Management Level** = Dredged material exceeds target mound height by more than 2 ft within an area greater than 2,000 x 2,000 ft. ACTION: Assess accumulation in surrounding cells and overall site capacity. Stop using the area of the site exhibiting accumulation. Assess potential wave impacts using STWAVE and determine appropriate action based on results.

5. Strategy

The goal of managing MCR disposal sites is to fully utilize each available site, while limiting the average vertical accumulation of placed dredged material so as to minimize the potential for adversely affecting wave conditions at or near the site. To successfully manage each site throughout the dredging season, the capacity of each site must be frequently assessed.

As a general rule, capacity assessment for an *active* disposal site (one that is being used) will occur based upon the frequency at which a given site's bathymetry is surveyed. The frequency of conducting surveys will be directly related to the rate at which dredged material is placed within a given site. In this regard, the frequency for assessing active disposal sites will be based on the rate of volume of dredged material placed within the site. The Portland District (OP-NW and EC-R) will, on a daily basis, collect operational dredging/disposal data at MCR (specifically, dump coordinates). The data will be transferred to EC-HY/HR for compilation and plotting. Figure 2 shows the flow diagram describing the procedure of processing monitoring data and using the processed data to manage disposal site capacity. If dredged material disposal (shown by daily tracking of dump locations) is occurring in a manner that is not desirable for proper site management, improvements to the disposal plan will be initiated within 1-2 days.

A weekly coordination briefing will be conducted between different Portland District offices and EPA-Region 10 on Tuesdays. On a weekly basis, Portland District (OP-NW) will prepare a report that summarizes the volume of dredged material placed and relate this data to the changes in capacity for active MCR disposal sites and, make recommendations for utilizing each site for the next week. Active dredged material disposal sites will be assessed according to the management thresholds listed in Section 4 "Decision Framework for Site Threshold Management". A draft of the weekly summary report will be furnished to EPA prior to public dissemination. The weekly summary report will be furnished via email, typically by the Friday of that week, to the members of the MCR Update Distribution List maintained by the MCR Channel O&M project manager (OP-NW).

Use of an active disposal site (or portion thereof) may be temporarily discontinued based on management indicators which could have the potential for exceeding the target accumulation within the site, the status or location of the dredges and hydrosurvey vessels, priority use of sites, or other site use constraints. Weekly recommendations may address revision of monitoring needs (i.e. site bathymetry surveys) or the collection of additional operational data to be used for the purpose of improving the assessment of disposal site capacity. Data required to monitor the weekly progress of site utilization includes: bathymetry surveys; analysis of surveys (plotting, differencing, or other processing); tracking of disposal locations within each site; and other pertinent information provided by the dredge operators. See figure 2 for the flow diagram describing the work elements for monitoring and managing disposal site capacity.

Within the collective constraints of available MCR disposal sites, preference is given to using ODMDS E and the North Jetty (NJ) site. However, based on MCR surveys conducted during May 2004, ODMDS E and the NJ site do not have sufficient capacity to meet the requirements for dredged material disposal. The Deep Water (DW) Site will be used to supplement disposal site capacity at MCR during 2004 (refer to Section 7, fourth paragraph). It is intended for the contract dredge to be place 1- 1.5 million cubic yards in ODMDS E, up to 0.25 million cubic yards in the NJ site, and up to 0.5 million cubic yards in the DW Site (103 area). The government dredge is expected to place 2.0 million cy in the DW Site (103 area) and possibly use the NJ Site, if available. Subsequent surveys of the ODMDS E and NJ Site (during 2004) may show increased erosion within these areas, which may result in additional capacity for dredged material disposal. This would effectively reduce the volume of dredged material that would be placed at the DW Site (103 area) for the contract dredge, and possibly the government dredge.

It is noted that ODMDS E will require focused attention during dredged material placement and monitoring to ensure that the site is fully utilized without exceeding the site's management target. The ODMDS E will be managed such that the site may be under-utilized, rather than attempting to achieve full utilization of the site at the risk of exceeding the site's capacity constraints. Figures 3a-b shows the flow diagram describing the procedure for assessing site capacity and directing the government and contractor dredges to specific MCR disposal sites.

6. Survey Frequency for Monitoring Dredged Material Accumulation

Minimum site monitoring requirements are a pre- and post -disposal bathymetry survey for each active MCR disposal site and a 2 x 2 mile area on Peacock Spit. Refer to figure 4 for survey coverage at MCR. The ODMDS E and the NJ Site will be surveyed at least once a month during the 2004 MCR dredging season. If the DW Site (103 area) is used during 2004, the site would be surveyed at the end of the dredging/disposal season. For active disposal sites, the survey frequency may differ from the minimum requirements, as specified in Table 2.

For all sites that are actually being used, an alternative Frequency for Site Monitoring (FSM) will be based on: The volumetric rate ($\forall$) at which dredged material is begin placed, the area (A) over which the dredged material is being placed, and the vertical target (H) for dredged material accumulation. It is noted that as a given site (or portion thereof) is "filled" with dredged material, H will change (become less with time). The FSM may need to increase as a site is being filled. FSM will be re-assessed each time an active site is surveyed. An entire disposal area need not be surveyed during each survey; only the parts of the site receiving dredged material and adjacent areas (within 1,000 ft of disposal activity). If the FSM becomes too frequent, then the disposal area may be considered "filled" and not used until sufficient dredged material dispersion occurs (as determined by site monitoring).

Equation 1 was used to estimate survey frequency for each site. Note that FSM (equation 1) assumes: The survey will be conducted at the midpoint of a site's total remaining capacity; dredged material is continuously placed at the site; and 20% of the site's area is not used. Table 2 specifies the initial FSM for each site based on initial conditions for 2004 and other parameters as shown. Note that the FSMs in table 2 will require revision as the capacity (allowable accumulation height) of each site is reduced by dredged material disposal.

Frequency of Site Monitoring (FSM)
= (Target Height/2) x (Site Area*0.8/$\forall$olume placed per day) [Equation 1]

Example: Initial FSM for the Eastern half of Site E for contract dredge is:
= (6/2) x (190*43560*0.8 /45,000*27) = 16 days.
…this is halfway thru the total time expected to fill the site.

Table 2. Values used to estimate Initial Frequency of Site Monitoring (FSM) for 2004.

Disposal Site	Target Mound Height (H,ft)*	Area (A, acres)*	Volume of DM Placed (∀,CY/day)♣ *Government*		*Contractor*	FSM** (days)
Site E – East	6	190	55,000	or	45,000	13 or 16
Site E– West	2	100	50,000	or	35,000	3 or 4
Overall Site E	4	290	52,000	or	40,000	15 or 20
NJ Site	3	100	55,000	or	40,000	3 or 4
DW Site (103)	40	207	37,000	or	25,000	145 or 214

* = Based on present values and will change as a site is filled; may be redefined based on subsequent site surveys.

**= time interval between FIRST successive surveys, assuming site in continuously used AND that dredged material is placed evenly throughout available disposal area. Frequency for Site Monitoring

♣= values based on recent average production rates – values will be changed if 2004 production rates are higher

As a given disposal site is "used", the interval between successive surveys will become smaller. Table 3 shows an estimated schedule for surveying MCR disposal sites during 2004, assuming that disposal occurs continuously in the site and that dredged material is placed uniformly within the available area. The values shown in () are the revised FSMs, following the initial value. An example of how to read table 3 is given for Site E – Eastern half, and assumes that dredged material is continuously and evenly placed from day 1using a contract hopper dredge (production of 45,000 cy/day):

1) 16 days after commencement of the disposal operation, the site would be surveyed and remaining capacity assessed.
2) After 8 additional days, the site would be re-surveyed and re-assessed. The total time for disposal would be 24 days.
3) After 4 additional days, the site would be re-surveyed and re-assessed. The total time for disposal would be 28 days.
4) After 2 additional days, the site would be re-surveyed and re-assessed. The total time for disposal would be 30 days.
5) After 1 additional day, the site would filled. The total time for disposal would be 31 days.

Table 3. Estimated successive frequency of site monitoring, based on contract dredge production rates.

Disposal Site	Initial FSM	2nd FSM	3rd FSM	4th FSM	5th FSM	
	days, starting from when site is first used in 2002 (days from previous FSM)					
Site E – East	16	24 (8)	28 (4)	30 (2)	31 (1)	Filled –1.3MCY
Site E – West	4	6 (2)	7 (1)	Filled – 300 KCY		
Overall Site E	20	30 (10)	35 (5)	38 (3)	39 (1)	Filled-1.6MCY
NJ Site	4	6 (2)	7 (1)	Filled--260KCY		
DW Site	214	Survey DWS at Beginning and End of Dredging Season**				

Values indicate cumulative time for which site has been used during 2004.
Values in () indicate successive FSM; or the time that the site can be used been used between successive surveys. When the FSM becomes less than 3 days, use of the site may be temporarily halted while site capacity is evaluated.
** Post-Survey of DWS occurs only if the site has been used in 2004.

7. Utilization of Active Disposal Sites during Monitoring and Other Conditions

Based on May 2004 surveys of the MCR and the present contracting agreement, the contract dredge will place dredged material within the Site E, the DW Site (103 area), and possibly the NJ Site. The government dredge will place dredged material within the DW Site (103 area), and possibly the NJ Site.

Under certain conditions, active disposal sites may be left alone and others will be used. For example, the government dredge has no on-dredge survey capability. This means that when the NJ Site (used by the government dredge) is being surveyed to assess remaining site capacity, the government dredge may use another disposal site until the site's remaining capacity has been assessed. This will typically take 1-2.5 days. During each site assessment period, the government dredge may use the NJ site (if available) or the DW Site.

USACE will also monitor the contractor disposal area according to the FSM. However, the contractor will not need to depart the active site during USACE surveys and site capacity assessment, UNLESS the management threshold is above Level #3 ("threshold capacity level" or higher). In which case, the contractor may leave the active site and use another while USACE determines available capacity (2-2.5 day activity).

Based on May 2004 surveys (showing a large dredging requirement at MCR and low site capacity within the nearshore disposal sites), the DW Site may receive more than 2 million cy of dredged material during 2004. During periods of rough bar conditions; ODMDS E or the NJ Site may not be available for use; in which case the DW Site may be used. At times during the 2004 dredging season, both contract and government dredges may relocate to other work areas.

8. Optimization of Site Capacity

During 1997-2003, ODMDS E had been the principal disposal site for MCR project maintenance dredged material; 67% of all MCR dredged material (sand) was placed in Site E. More than 90% of the material placed within the ODMDS E during 1997-2003 has been dispersed by waves and currents, in a north-northwesterly direction onto Peacock Spit. Less than 5% of the dredged material placed at the ODMDS E has been transported southward into the MCR navigation channel. Continued use of ODMDS E as a primary disposal site is of strategic importance to the MCR federal project and environment [USACE 2003]. However, surveys recently conducted at MCR during May 2004 indicate that the entire entrance has experienced approximately 2 ft of deposition (including ODMDS E), in addition to the normal shoaling that occurs at specific areas within the navigation channel. Based on the May 2004 surveys, the volume available under the "threshold mound height" at the ODMDS E in 2004 is less than half than observed during 1997-2003. This will provide a challenge for MCR disposal management at Expanded Site E and with the other available disposal sites.

ODMDS E and NJ Site. The level to which the ODMDS E can be used for dredged material disposal is related to the capacity available within the site, and the efficiency to which the site's capacity is used. Regardless of the capacity available within the site, full utilization of ODMDS E capacity can be achieved by promoting even deposition of dredged material throughout the entire site's boundary. This means that the dredged material would be placed though out the entire site, both in space and time, using a regimented procedure to produce a uniform continuous layer on the seabed, avoiding the formation of any localized mounding.

To promote even and controlled deposition of dredged material within ODMDS E and NJ Site, the sites were partitioned into a system of cells (about 500 x 500 ft, see figure 1a). Initial dump assignments are made for each cell within a given site based on the target mound heights (elevations) for dredged material accumulation. The cell assignments (dumps per cell) will be periodically refined as a given site is "filled". As areas of a site become filled; filled cells are either minimally used or are restricted from use. To facilitate coordination of site assessment, the same placement grid will be used by the contractor and government dredges. Figures 5 and 6 show initial cell assignments for the ODMDS E and NJ Site and constitute the initial disposal plan for each site for 2004.

During 2004, placement of dredged material within either ODMDS E of the NJ Site will be conducted according to the following specification. ODMDS E and NJ Site shall be filled uniformly with no more than one load difference between any two cells: All cells must be filled with one load before placing a second load in any cell; all cells designated for two loads must be filled before placing a third load in any cell, etc. When recording the placement location, material shall be credited to the cell in which the disposal operation is started regardless of the number of cells disposed in. Each load shall be distributed across no less than 2 cells. No more than 50% of a hopper dredge load shall be placed within any given grid cell.

Deep Water 103 Site. Dredged material placement with the DW Site will be conducted in manner similar to ODMDS E. The intent is to confine the areal dispersal of dredged material placed within the 3,000 ft x 3,000 ft "drop zone" of the DW Site without promoting excessive vertical accumulation of placed dredged material. Refer to figure 11 and 12. The vertical limit for total dredged material accumulation (on the seabed) with the DW site is 40 ft. The DW Site shall be filled uniformly with no more than 5 loads difference between any two cells. When recording the placement location, material shall be credited to the cell in which the disposal operation is started regardless of the number of cells disposed in. Each load shall be distributed across no less than 1 cell. To allow simultaneous use of the DW Site by both the government and contract hopper dredges, the "drop zone" will be partitioned for use by each dredge as shown in figure 12.

9. Data Reporting Requirements

Field Data to be Provided to NWP: Field offices and Portland District will conducted an internal briefing every Tuesday. Contract and government hopper dredge disposal coordinates will be provided to NWP-OP-NW and EC-HY/HR digitally every day while the dredges are working at MCR. Other data may be transferred to OP-NW and EC-HY/HR, as adaptive site management requirements dictate. EC-HY will plot dump coordinates to verify that the active disposal sites are being used as intended. Results will be provided to EC-HR, EC-R, and OP-NW weekly; unless deviations are observed, in which case results will be provided to subject offices immediately. OP-NW should provide hydrographic survey information to EC-HY in a timely format. EC will compile survey information and disseminate according to the flow diagram in figure 2. These data will be coordinated with EPA.

Updates from NWP to Public: The Portland District (MCR project manager) will send out email updates to collaborating agencies and interested stakeholders every Friday. Other data may be sent, as adaptive site management requirements dictate.

APPENDIX A

The Hopper Dredge

A hydraulic hopper dredge is a self-propelled seagoing ship with sections of its hull compartmented into one or more hoppers. It is normally configured with two drag arms, one on each side of the dredge. During dredging, bottom sediment is sucked into the drag arm by hydraulic pumps and deposited into the dredge's hoppers. The dredged material enters the hoppers in slurry form and settles to the bottom as excess water flows over the top of the hoppers. Once the hoppers are full, the drag arms are lifted, and the dredge transits to the disposal area where the dredged material is usually dumped thru doors located on the bottom of the ship (hoppers). In some cases, the hopper dredge can use its pump to discharge the dredged material directly overboard or thru a pipeline to a disposal site not reachable by the hopper dredge (ie. beach, upland, or nearshore locations). The operating parameters for several dredges that have been used at MCR are shown below.

Table A-1. Operating parameters for hopper dredges commonly used at MCR

DREDGE	OVERALL DIMENSIONS length (ft)	beam (ft)	draft(ft) loaded/empty	CAPACITY load-average (cy)	VESSEL type	TIME TO PLACE open water dump (minutes, per load)	pump-out (minutes, per load)
Newport*(Cntr)*	300	55	20/10	3,000	split-hull	4 to 8	N/A
Sugar Island*(Cntr)*	281	52	19/8	2,300	split-hull	4 to 8	80 to 100
Padre Island*(Cntr)*	281	52	19/8	2,700	split-hull	4 to 8	N/A
Essayons*(Gvt)*	350	68	27/15	5,400	bottom doors	6 to 15	120 to 140*
Stuyvesant*(Cntr)*	372	72	29/17	6,800	bottom doors	6 to 15	130 to 160

*** will have pump-out capability in 2008**
During 2004, the *Essayons* and *Sugar Island* will be used to maintain the MCR bar

Hopper dredges are used mainly for dredging in wave exposed or high current areas where traffic and operating conditions preclude the use of more stationary dredges and their attendant pipeline or dump scows. Hopper dredges are effective working offshore and in entrances where sea and weather conditions preclude the use of extensive dredge pipe. Most hopper dredges are capable of operating in ocean swell 10 ft high and they are important for accessing disposal sites many miles from the dredging location. The government hopper dredge (*Essayons*) utilizes a series of "doors" located on the hull bottom to release each load of dredged material. The bottom doors are sequentially opened during disposal until the entire load of dredged material is released form the vessel, resulting in a gradual release of dredged material from the vessel. Contractor hopper dredges typically employ a split-hull design. A split-hull hopper dredge releases its load of dredged material by opening (splitting) the entire hull of the vessel. The split-hull method of disposal is more rapid (efficient) than bottom-door hopper dredges. While the use of split-hull hopper dredges reduces the time required for material disposal, split-

hull dredges reduce the horizontal dispersal of dumped dredged material on the seabed while increasing the vertical extent of accumulation per dump.

MCR Disposal Site Utilization Procedures and Governing Constraints

Information used to formulate the use strategy for individual MCR disposal sites was obtained from the annual report "*Utilization of MCR Ocean Dredged Material Disposal Site during 2003 and Recommendations for 2004"* [USACE 2004]. All water depths are specified with respect to MLLW.

Shallow Water Site (Site E): As of 13 May, the *total* target capacity within the Shallow Water Site (Site E) was about 2.6 MCY (this assumes that dredged material accumulates to the target level, described in Table 1, accounting for dredged material side slope only). The site's present *effective* target capacity is 1.6 MCY; this is the volume that can be realistically placed within the site (accounting for "edge" effects along the site's boundary). Refer to figures 5, 7, and 8 for ODMDS E constraints. The western half of the site is typically less dispersive than the eastern half of the site and may be unavailable for dredged material disposal after 15 August. Figure 7a shows the *target contour elevations* for ODMDS E: These contours account for a 5-ft accumulation added onto the site's baseline (1997) bathymetry. Figure 8 shows the *contour heights* at which dredged material can accumulate within the site, without exceeding the site's management target (with respect to May 1997), based on the 13 May 2004 survey. As of 13 May, the average height of accumulation at the target contour elevations for the eastern and western areas of ODMDS E is 6 ft and 2 ft respectively. Due to the goal of not exceeding the management target for dredged material accumulation within ODMDS E (with respect to the baseline condition- May 1997), dredged material should be placed such that it accumulates uniformly throughout the site, both in space and time. This means that an entire site should be utilized, to the maximum extent practicable.

NJ Site: The average water depth within the NJ Site is about 45 ft. The present target capacity of the NJ site (for the 2004 dredging season) is 260 KCY, assuming that 70% of the NJ site is permitted to accumulate dredged material to a height of 8 ft (with respect to the site's baseline 1999 condition). Refer to figures 9 and 10. Due to the relatively shallow water depths thru the NJ Site, care should be taken to place dredged material such that it accumulates evenly within the site and the entire site should be utilized, to the maximum extent practicable. It may be advantageous to first use the eastern half of the NJ site, then fill in the western half; so as not get "blocked" from using the eastern half of the site--- should accumulation within the western part of the site restrict dredged access due to keel clearance.

Deep Water Site: The DW Site (MRPSA section 103 boundary) occupies an area of 7,000 x 7,000 ft and lies 6 miles offshore from MCR in a water depth of 225 ft (see figure 1). The DW Site has not been used for dredged material disposal, prior to 2004. The capacity for dredged material disposal within the DW Site (103 boundary) is greater than 7.5 million cy . Use of the DW Site is expected to occur ONLY when the other disposal sites have been used to the maximum extent practicable or when inclement weather conditions eliminate the safe use of the other disposal sites. Placement of dredge material

would occur within a smaller 3,000 X 3,000 foot (207 acres) "drop zone" area so that material does not leave the larger 7,000 X 7,000 foot site boundaries as sand is dispersed from the dredge through the water column. Refer to figures 11-12. The intent is to confine the areal dispersal of dredged material placed within the 3,000 ft x 3,000 ft "drop zone" of the DW Site without promoting excessive vertical accumulation of placed dredged material. The vertical limit for dredged material accumulation (on the seabed) with the DW site is 40 ft.

Other Site Previously Used: The MPRSA Section 103 part of ODMDSs A, B, and F (as expanded in 1993) expired in Fall 2002. For 2003 and beyond, only the original EPA-designated areas (Section 102) of ODMDSs A, B, and F remain in existence. Refer to figure 1. EPA considers these sites full and is in the process of de-designating them. Therefore, ODMDSs A, B, and F are not available for use during 2004.

References

Ebersol (1986). "Regional Coastal Processes Numerical Modeling System: RCPWAVE – A linear wave propagation model for engineering use", TR CERC-86-4, Waterways Experiment Station, USACE, Vicksburg, MS.

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Smith, J.M., Sherlock, A.R., Resio, D.T. (2001) " STWAVE: Steady-State Spectral Wave Model User's Manual for STWAVE, Version 3.0". ERDC/CHL SR-01-1. U.S. Army Corps of Engineers - Engineer Research and Development Center. Vicksburg, MS.

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USACE (2003). "Mouth of the Columbia River Shallow Water Ocean Dredged Material Disposal Site Supplemental Evaluation of Optimized Site Utilization and Assessment of Potential Wave-Related Impacts". Portland District – US Army Corps of Engineers.

USACE (2004). "Utilization of existing MCR ODMDSs during 2003 and Recommendations for 2004". Portland District – US Army Corps of Engineers

Mouth of the Columbia River - Bathymetry and 2004 Dredged Material Placement Sites

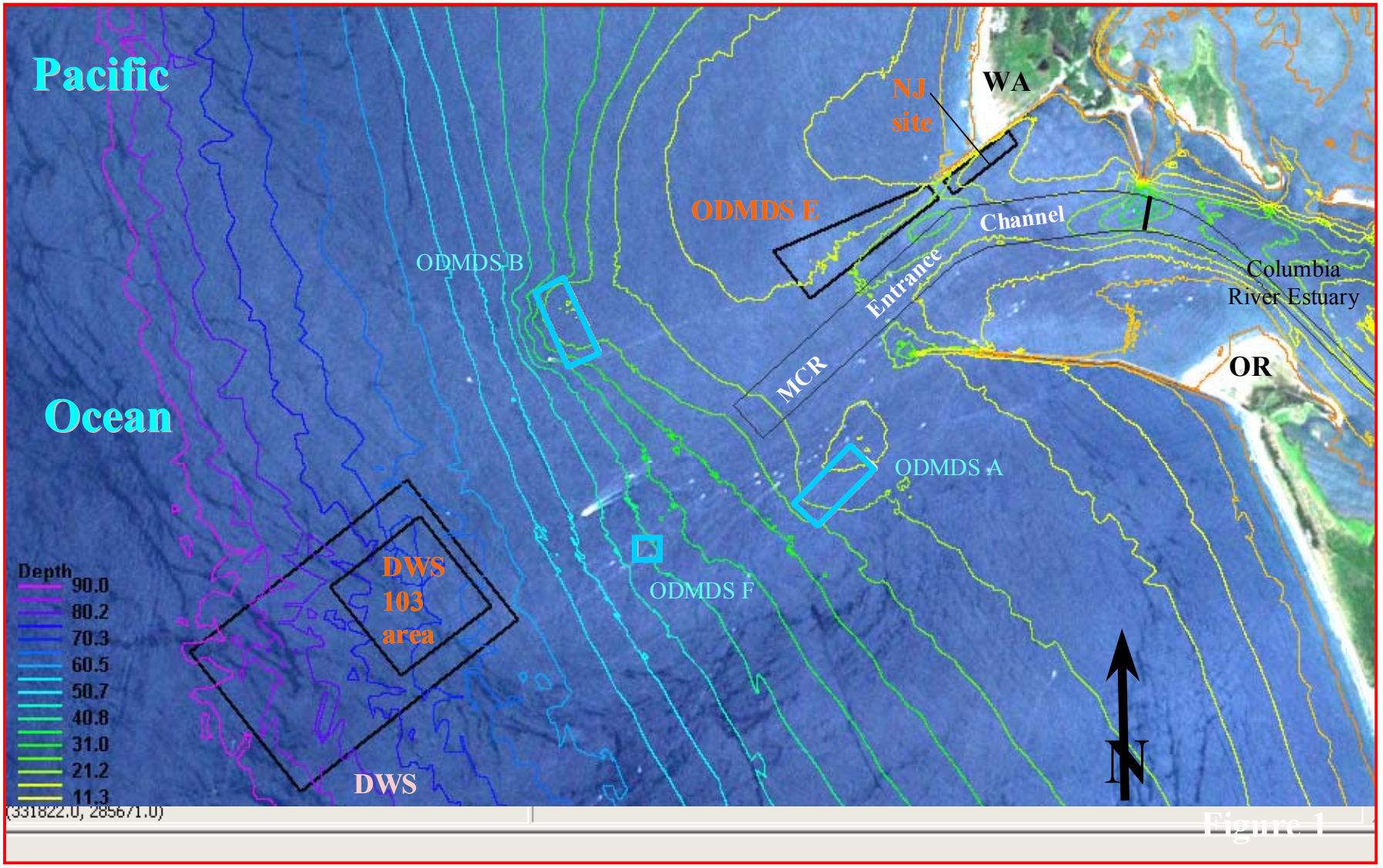


Figure 1

DWS= Deep Water Site ODMDS

SWS= Shallow Water Site (ODMDS E)

ODMDS = ocean dredged material disposal site, 102 and 103 MPRSA

NJ Site = North Jetty disposal site, CWA

2 miles

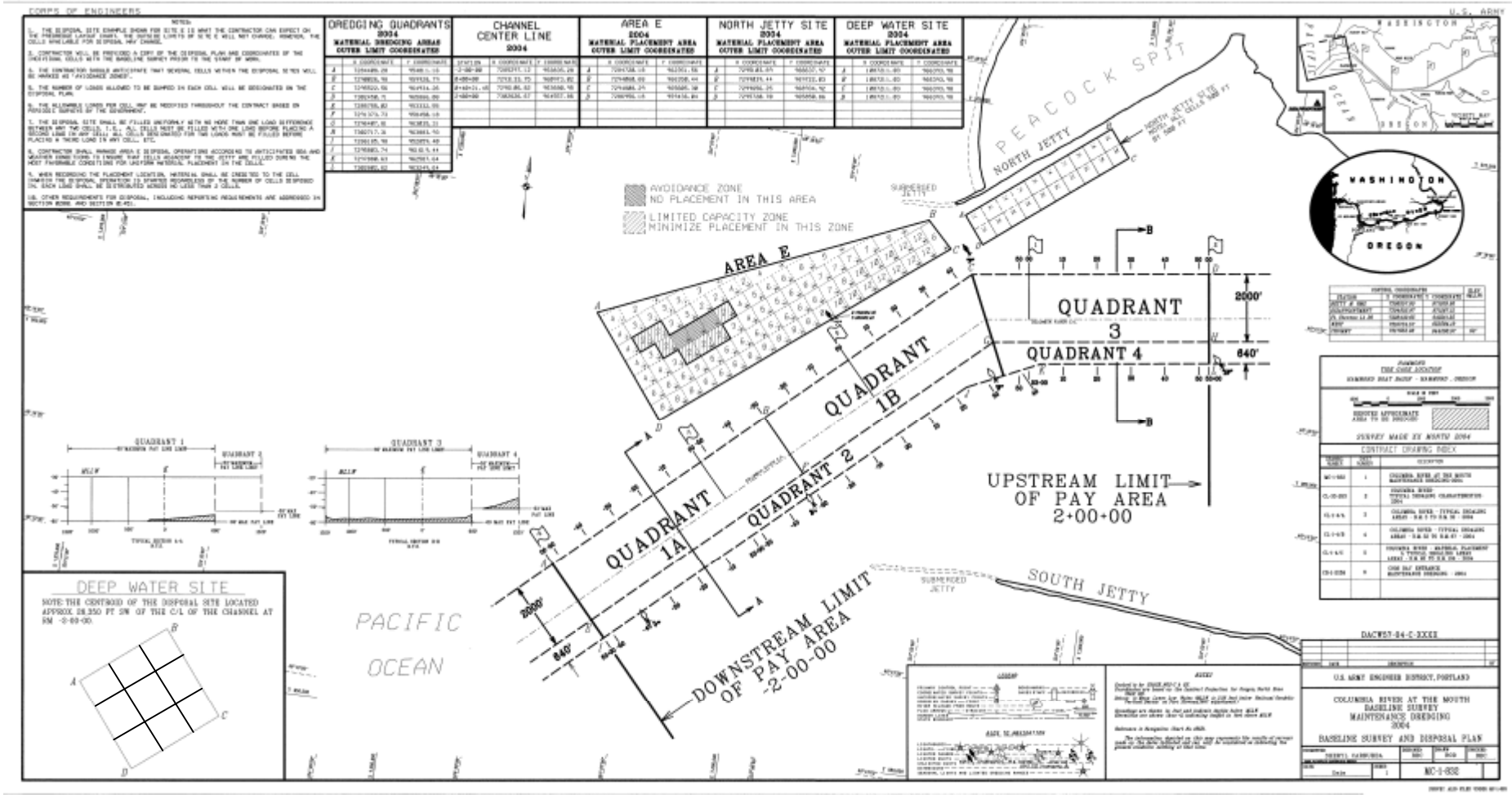

DREDGING QUADRANTS
2004
MATERIAL DREDGING AREAS
OUTER LIMIT COORDINATES
CHANNEL
CENTER LINE
2004
AREA E
2004
MATERIAL PLACEMENT AREA
OUTER LIMIT COORDINATES
NORTH JETTY SITE
2004
MATERIAL PLACEMENT AREA
OUTER LIMIT COORDINATES
DEEP WATER SITE
2004
MATERIAL PLACEMENT AREA
OUTER LIMIT COORDINATES
AVOIDANCE ZONE
NO PLACEMENT IN THIS AREA
LIMITED CAPACITY ZONE
MINIMIZE PLACEMENT IN THIS ZONE
PEACOCK SPIT
NORTH JETTY
SUBMERGED JETTY
AREA E
QUADRANT 1A
QUADRANT 1B
QUADRANT 2
QUADRANT 3
QUADRANT 4
2000'
840'
UPSTREAM LIMIT
OF PAY AREA
2+00+00
DOWNSTREAM LIMIT
OF PAY AREA
-2+00+00
SOUTH JETTY
PACIFIC
OCEAN
DEEP WATER SITE
NOTE: THE CENTROID OF THE DISPOSAL SITE LOCATED APPROX. OR 350 FT SW OF THE C/L OF THE CHANNEL AT RM -5+00+00.
WASHINGTON
OREGON
CONTRACT DRAWING INDEX
DACW57-04-C-XXXX
U.S. ARMY ENGINEER DISTRICT, PORTLAND
COLUMBIA RIVER AT THE MOUTH
BASELINE SURVEY
MAINTENANCE DREDGING
2004
BASELINE SURVEY AND DISPOSAL PLAN
MC-1-002

Figure 1a

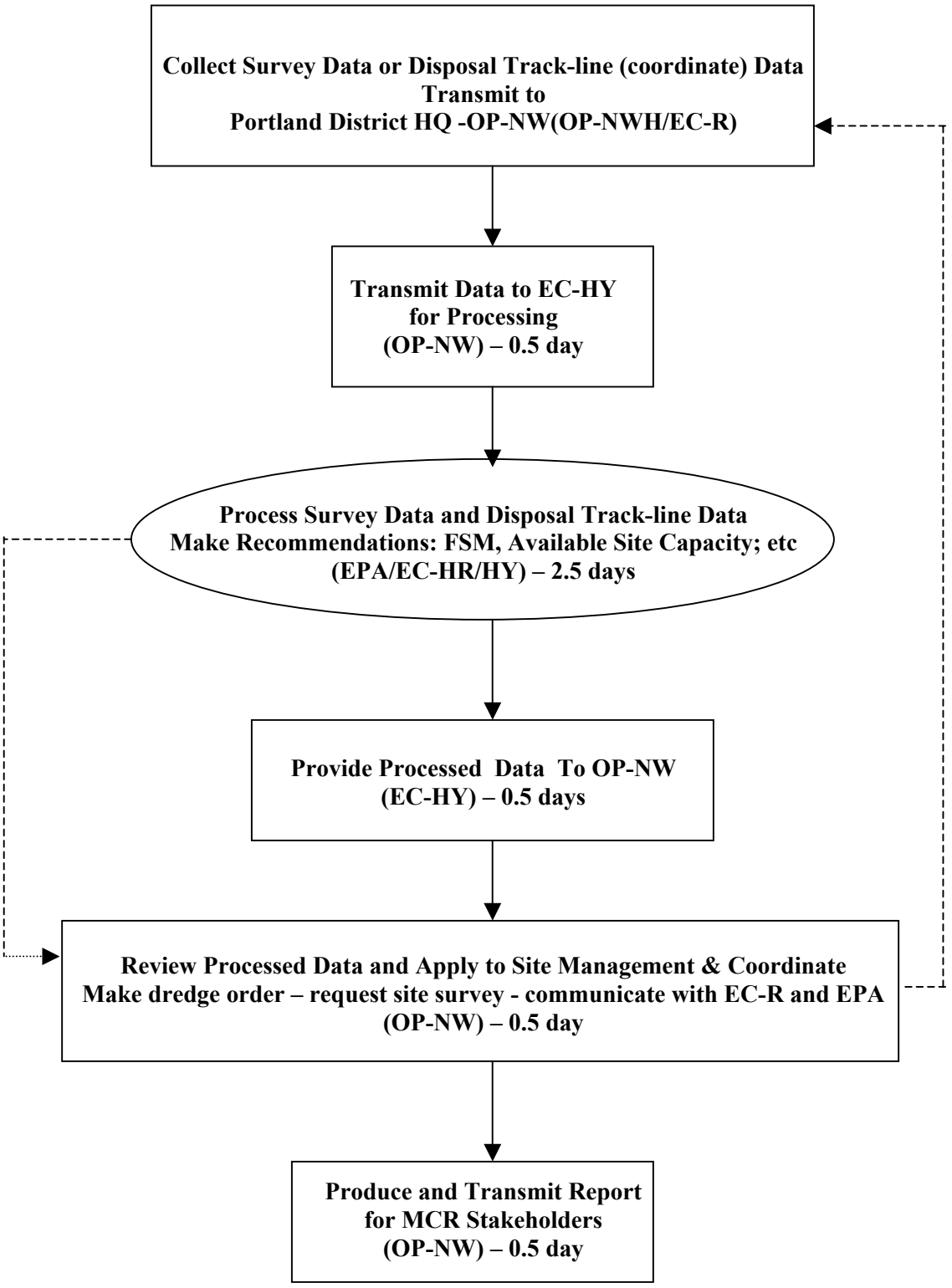


Figure 2. Flow diagram describing the procedure of processing monitoring data and using the processed data to manage disposal site capacity, at a frequency of 1 week or greater. Offices shown in () are assigned responsibility for task; expected duration of task is specified. FSM = frequency for Site Monitoring.

Government Dredge

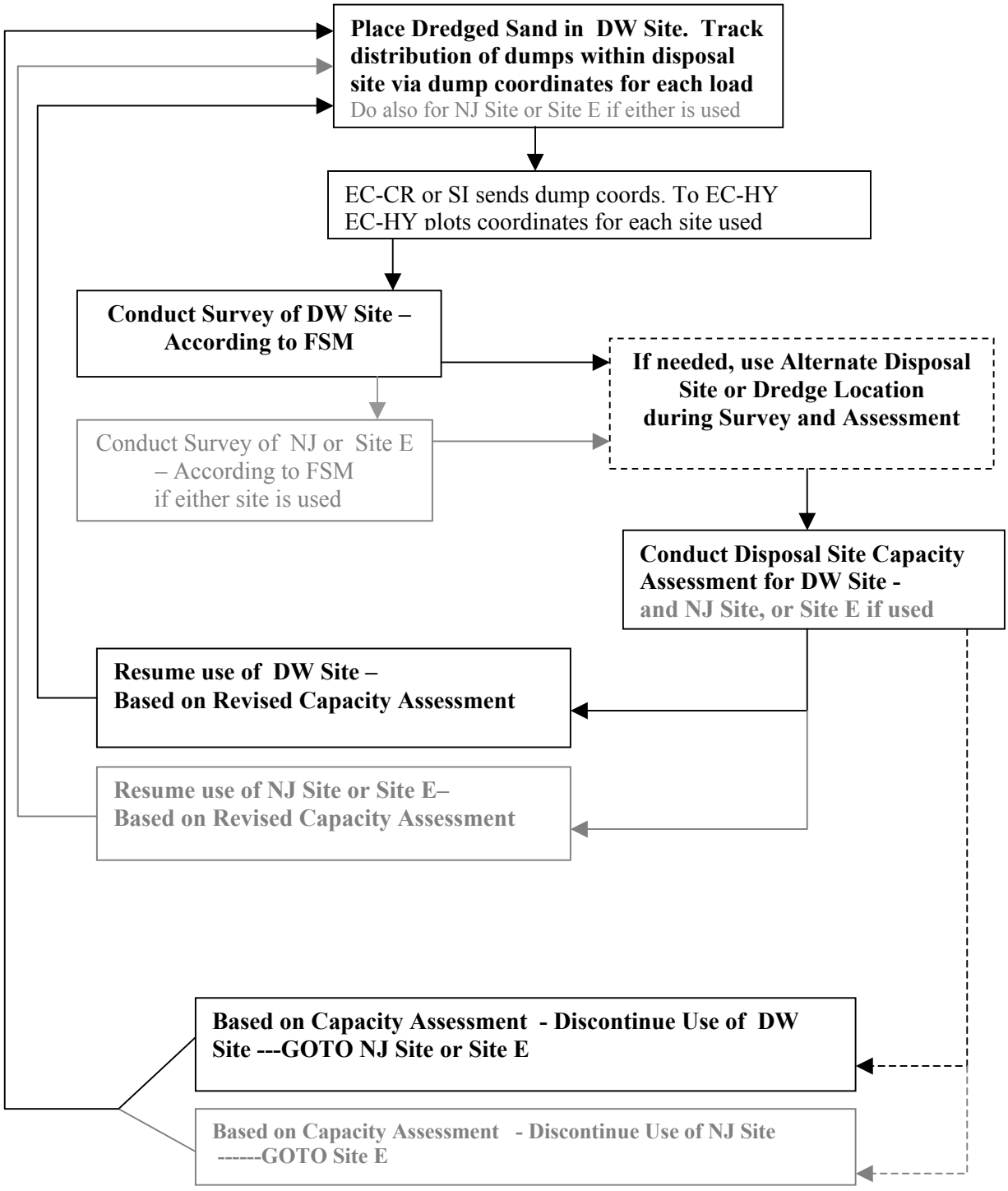


Figure 3a. Flow Diagram describing Action events for government dredge *Essayons* during dredging-disposal at MCR for 2004.

Contract Dredge

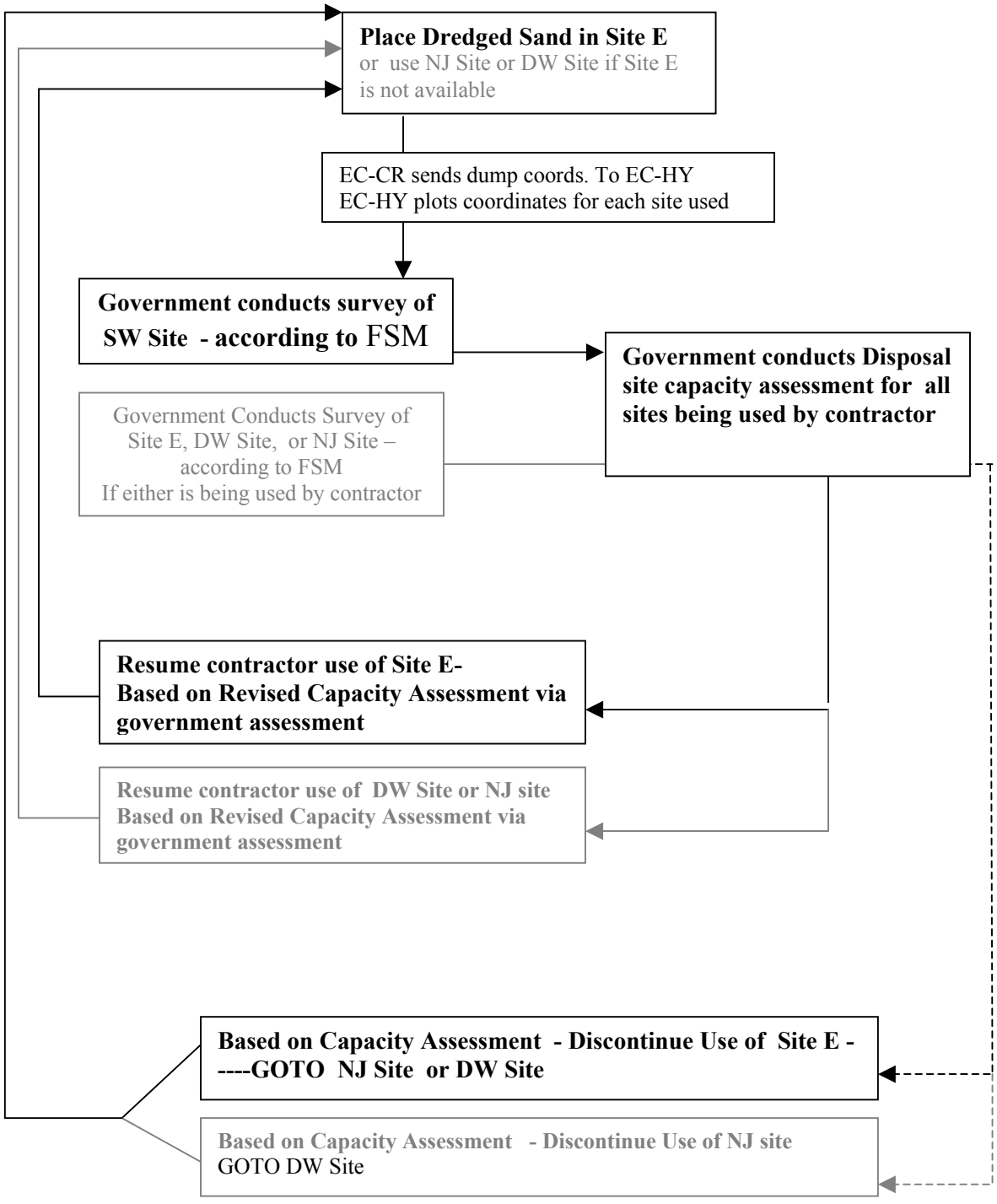
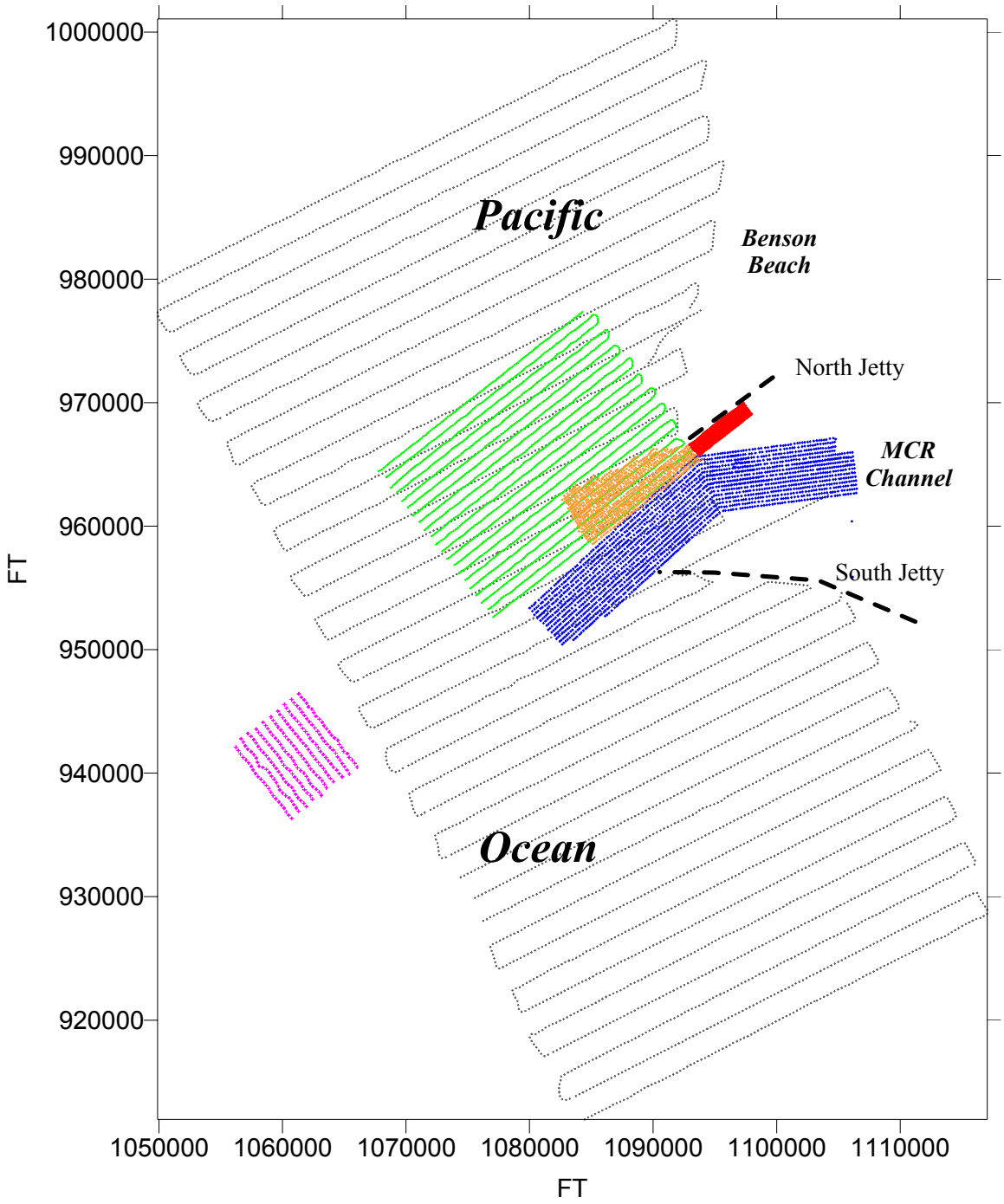


Figure 3b. Flow Diagram describing Action events for contract dredge during dredging-disposal at MCR for 2004.

MCR SURVEY DATA - COVERAGE



Grey = Approach Survey
Green = Peacock Spit , 2 x 2 mile
Purple = 103 Part of DW Site
Blue = MCR Channel
Orange = Site E (SWS)
Red = North Jetty Site

Figure 4

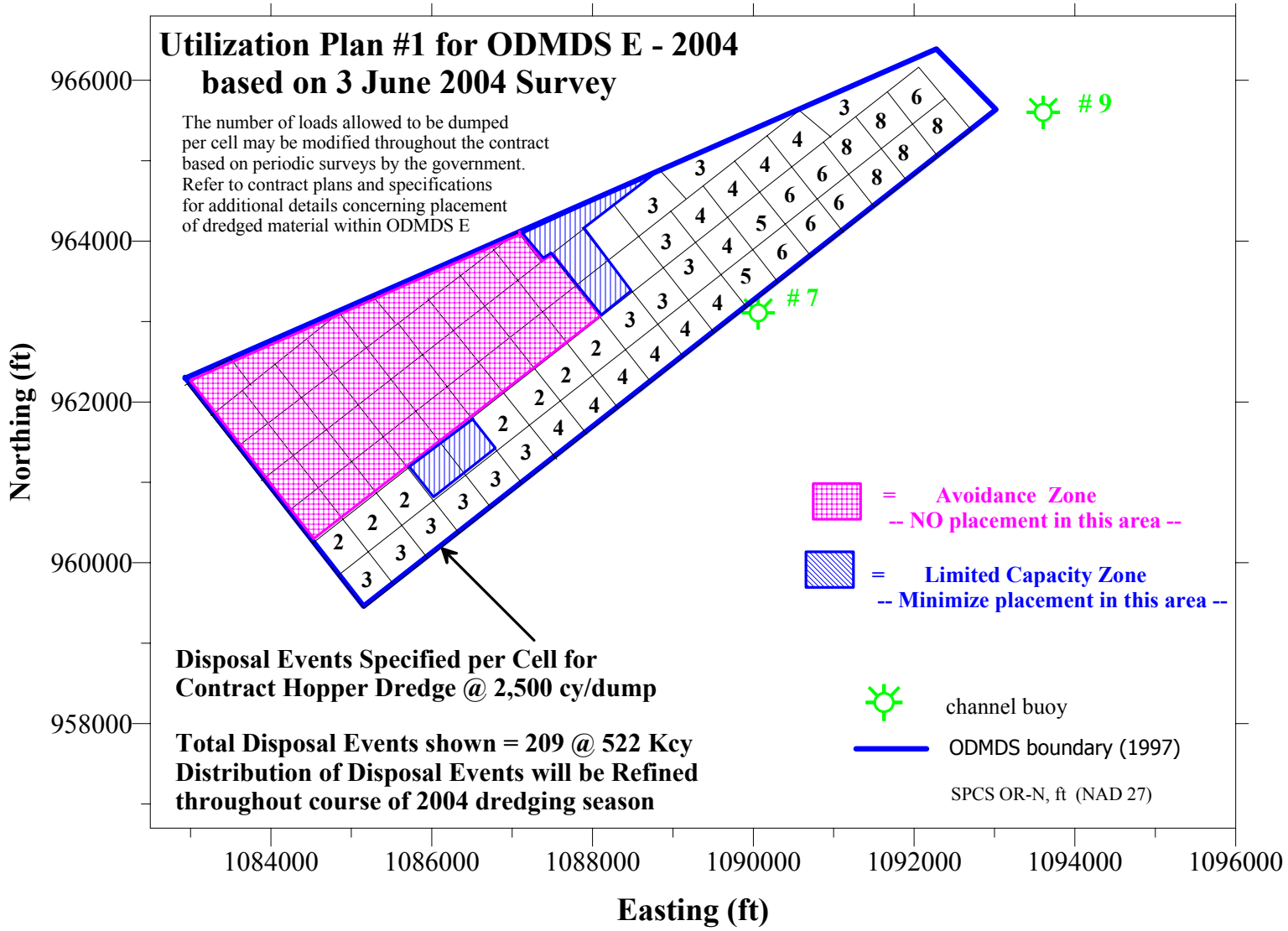

Utilization Plan #1 for ODMDS E - 2004
based on 3 June 2004 Survey
The number of loads allowed to be dumped per cell may be modified throughout the contract based on periodic surveys by the government. Refer to contract plans and specifications for additional details concerning placement of dredged material within ODMDS E
9
7
= Avoidance Zone
-- NO placement in this area --
= Limited Capacity Zone
-- Minimize placement in this area --
Disposal Events Specified per Cell for Contract Hopper Dredge @ 2,500 cy/dump
Total Disposal Events shown = 209 @ 522 Kcy
Distribution of Disposal Events will be Refined throughout course of 2004 dredging season
channel buoy
ODMDS boundary (1997)
SPCS OR-N, ft (NAD 27)
Northing (ft)
966000
964000
962000
960000
958000
1084000
1086000
1088000
1090000
1092000
1094000
1096000
Easting (ft)

Figure 5

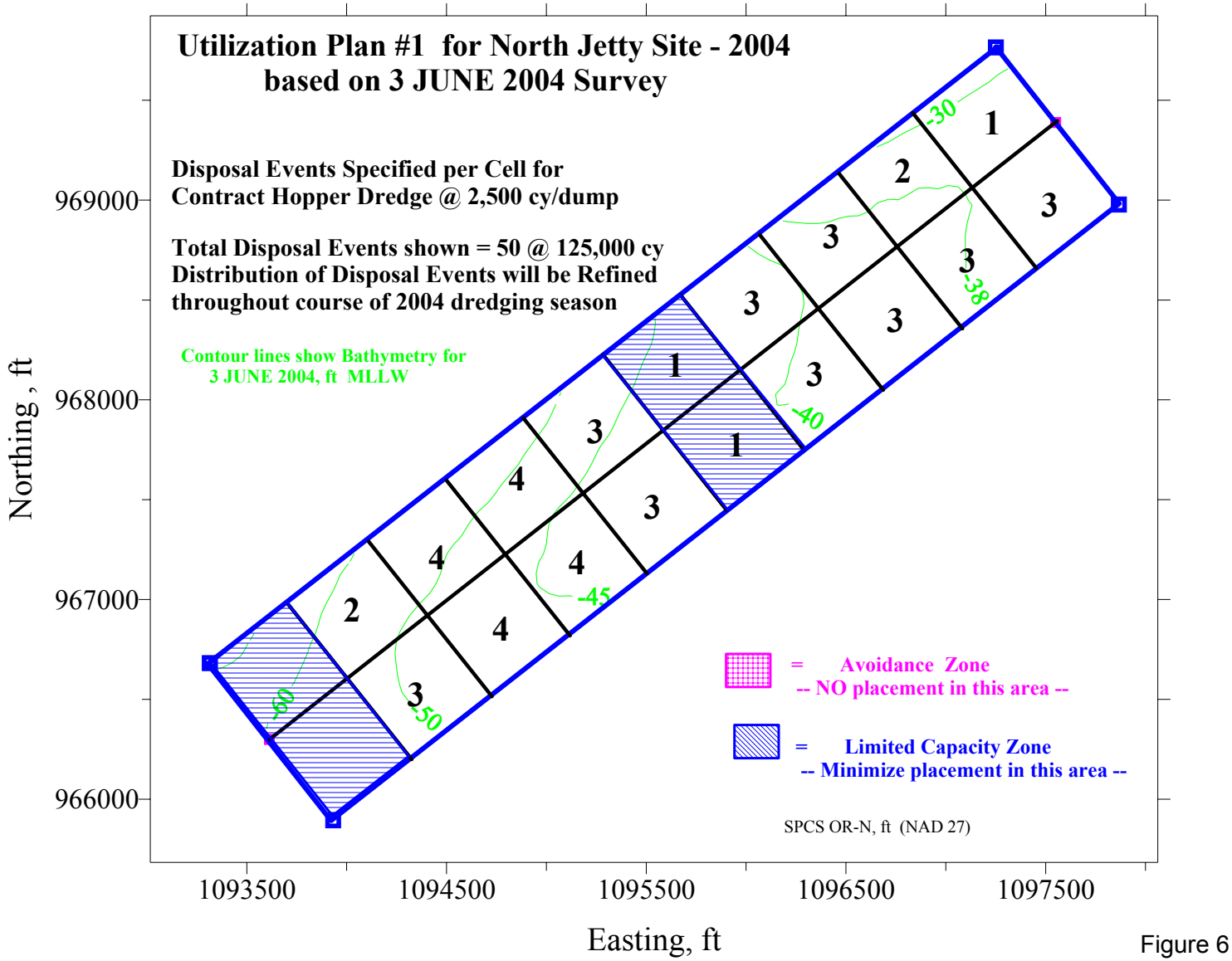

Utilization Plan #1 for North Jetty Site - 2004
based on 3 JUNE 2004 Survey
Disposal Events Specified per Cell for
Contract Hopper Dredge @ 2,500 cy/dump
Total Disposal Events shown = 50 @ 125,000 cy
Distribution of Disposal Events will be Refined
throughout course of 2004 dredging season
Contour lines show Bathymetry for
3 JUNE 2004, ft MLLW
-30
-38
-40
-45
-50
-60
= Avoidance Zone
-- NO placement in this area --
= Limited Capacity Zone
-- Minimize placement in this area --
SPCS OR-N, ft (NAD 27)
Northing , ft
969000
968000
967000
966000
Easting, ft
1093500
1094500
1095500
1096500
1097500

Figure 6

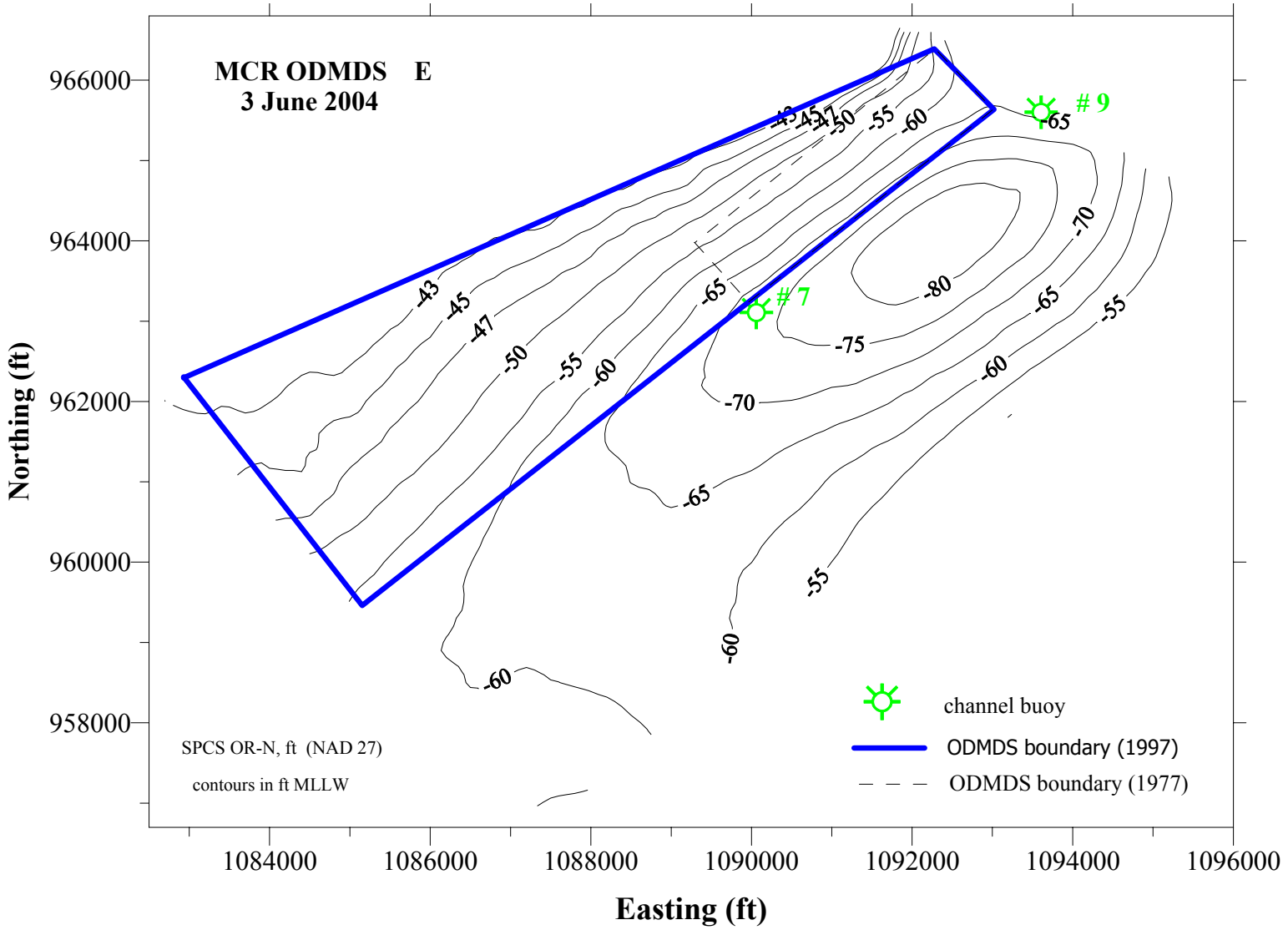

MCR ODMDS E
3 June 2004
9
7
-43
-45
-47
-50
-55
-60
-65
-70
-75
-80
channel buoy
ODMDS boundary (1997)
ODMDS boundary (1977)
SPCS OR-N, ft (NAD 27)
contours in ft MLLW
Northing (ft)
966000
964000
962000
960000
958000
Easting (ft)
1084000
1086000
1088000
1090000
1092000
1094000
1096000

Figure 7

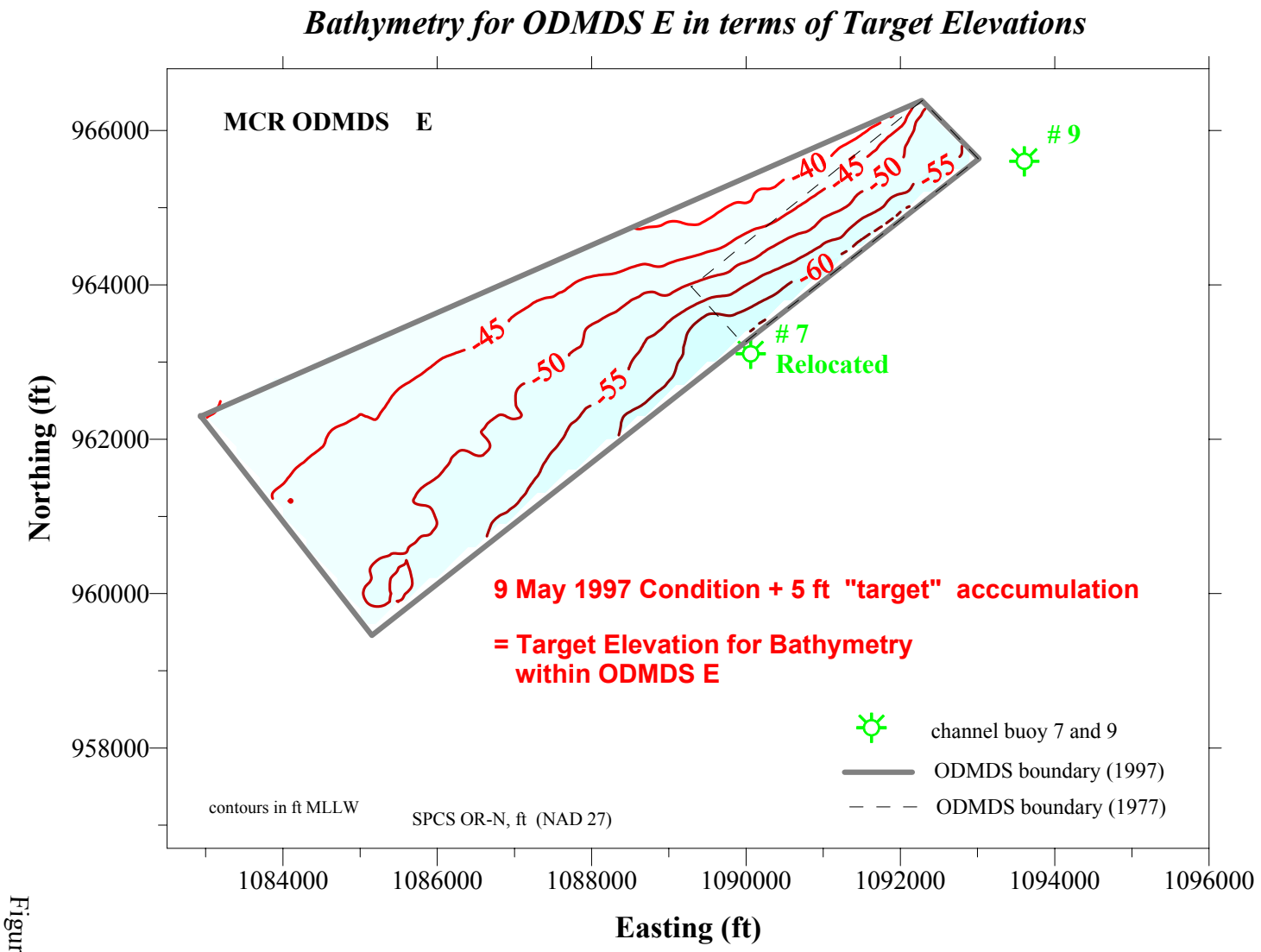

Bathymetry for ODMDS E in terms of Target Elevations
MCR ODMDS E
9
7
Relocated
-40
-45
-50
-55
-60
-45
-50
-55
9 May 1997 Condition + 5 ft "target" acccumulation
= Target Elevation for Bathymetry
within ODMDS E
channel buoy 7 and 9
ODMDS boundary (1997)
ODMDS boundary (1977)
contours in ft MLLW
SPCS OR-N, ft (NAD 27)
Northing (ft)
966000
964000
962000
960000
958000
1084000
1086000
1088000
1090000
1092000
1094000
1096000
Easting (ft)

Figure 7a

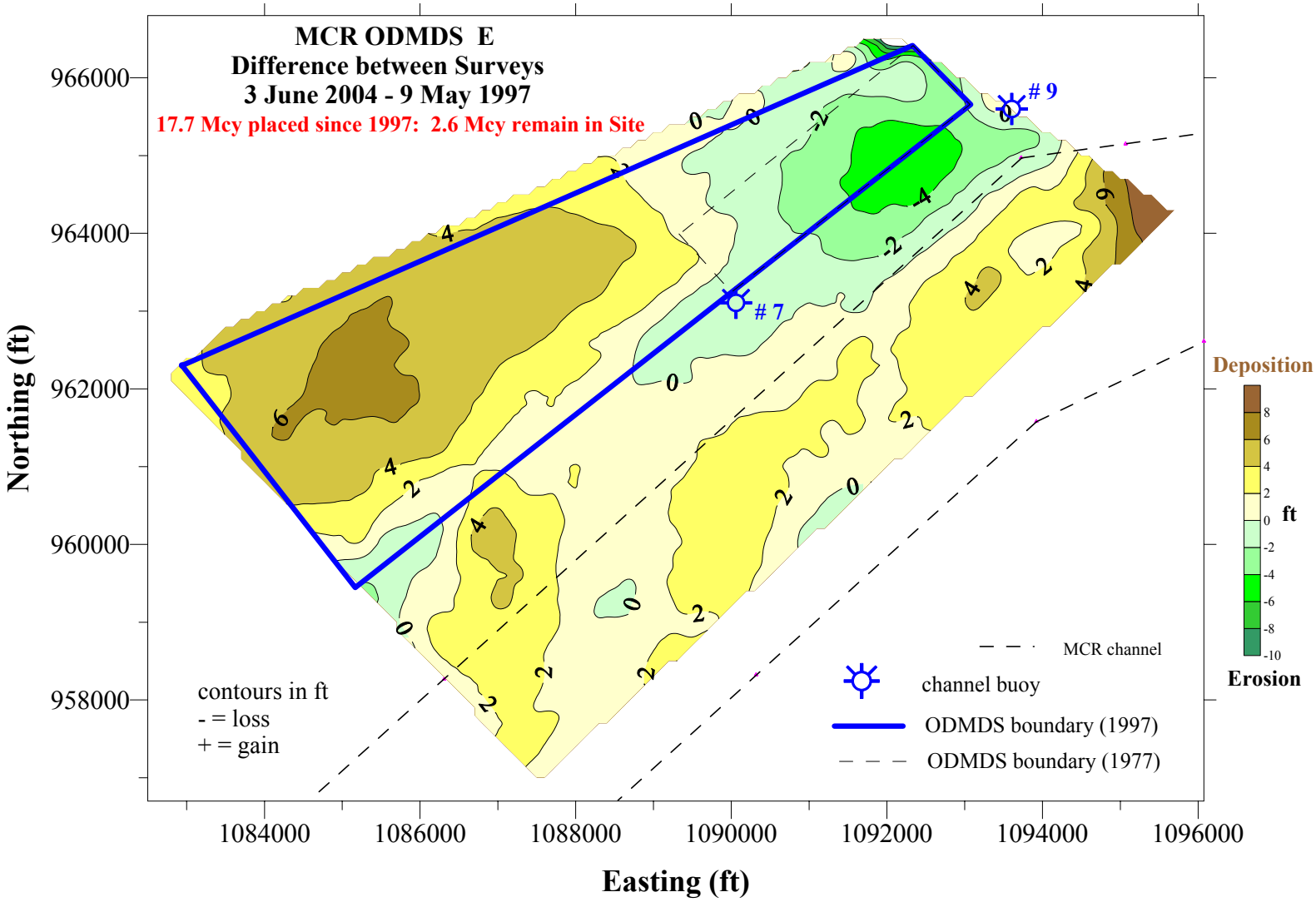

MCR ODMDS E
Difference between Surveys
3 June 2004 - 9 May 1997
17.7 Mcy placed since 1997: 2.6 Mcy remain in Site
9
7
Northing (ft)
966000
964000
962000
960000
958000
1084000
1086000
1088000
1090000
1092000
1094000
1096000
Easting (ft)
contours in ft
- = loss
+ = gain
MCR channel
channel buoy
ODMDS boundary (1997)
ODMDS boundary (1977)
Deposition
8
6
4
2
0
-2
-4
-6
-8
-10
ft
Erosion

Figure 7b

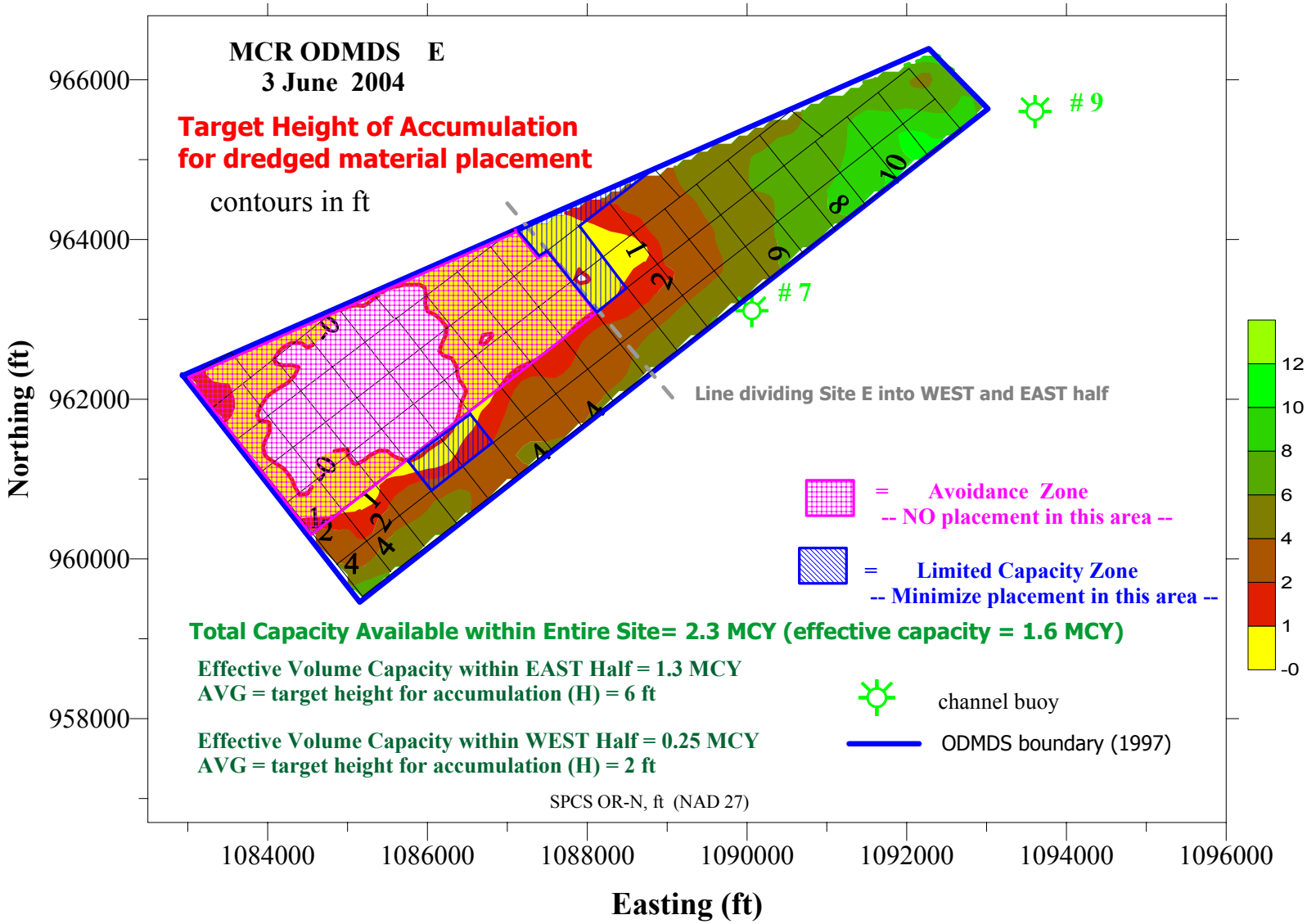

MCR ODMDS E
3 June 2004
Target Height of Accumulation
for dredged material placement
contours in ft
9
7
Line dividing Site E into WEST and EAST half
= Avoidance Zone
-- NO placement in this area --
= Limited Capacity Zone
-- Minimize placement in this area --
Total Capacity Available within Entire Site= 2.3 MCY (effective capacity = 1.6 MCY)
Effective Volume Capacity within EAST Half = 1.3 MCY
AVG = target height for accumulation (H) = 6 ft
Effective Volume Capacity within WEST Half = 0.25 MCY
AVG = target height for accumulation (H) = 2 ft
channel buoy
ODMDS boundary (1997)
SPCS OR-N, ft (NAD 27)
Northing (ft)
966000
964000
962000
960000
958000
1084000
1086000
1088000
1090000
1092000
1094000
1096000
Easting (ft)
12
10
8
6
4
2
1
-0

Figure 8

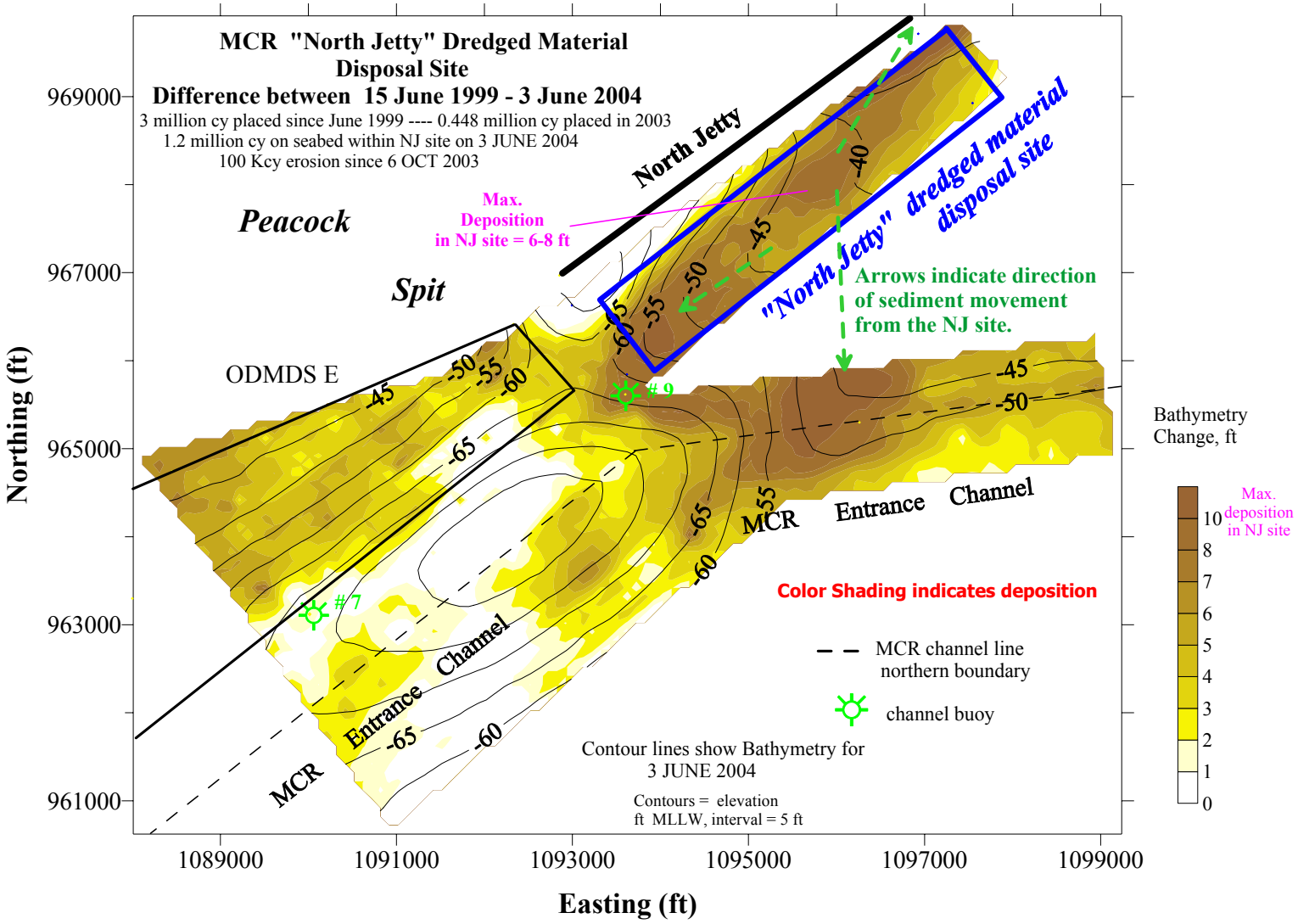

MCR "North Jetty" Dredged Material Disposal Site
Difference between 15 June 1999 - 3 June 2004
3 million cy placed since June 1999 ---- 0.448 million cy placed in 2003
1.2 million cy on seabed within NJ site on 3 JUNE 2004
100 Kcy erosion since 6 OCT 2003
Peacock Spit
Max. Deposition in NJ site = 6-8 ft
North Jetty
"North Jetty" dredged material disposal site
Arrows indicate direction of sediment movement from the NJ site.
ODMDS E
9
#7
MCR Entrance Channel
Color Shading indicates deposition
MCR channel line northern boundary
channel buoy
Contour lines show Bathymetry for 3 JUNE 2004
Contours = elevation ft MLLW, interval = 5 ft
Bathymetry Change, ft
Max. deposition in NJ site
10
8
7
6
5
4
3
2
1
0
Northing (ft)
969000
967000
965000
963000
961000
Easting (ft)
1089000
1091000
1093000
1095000
1097000
1099000

Figure 9

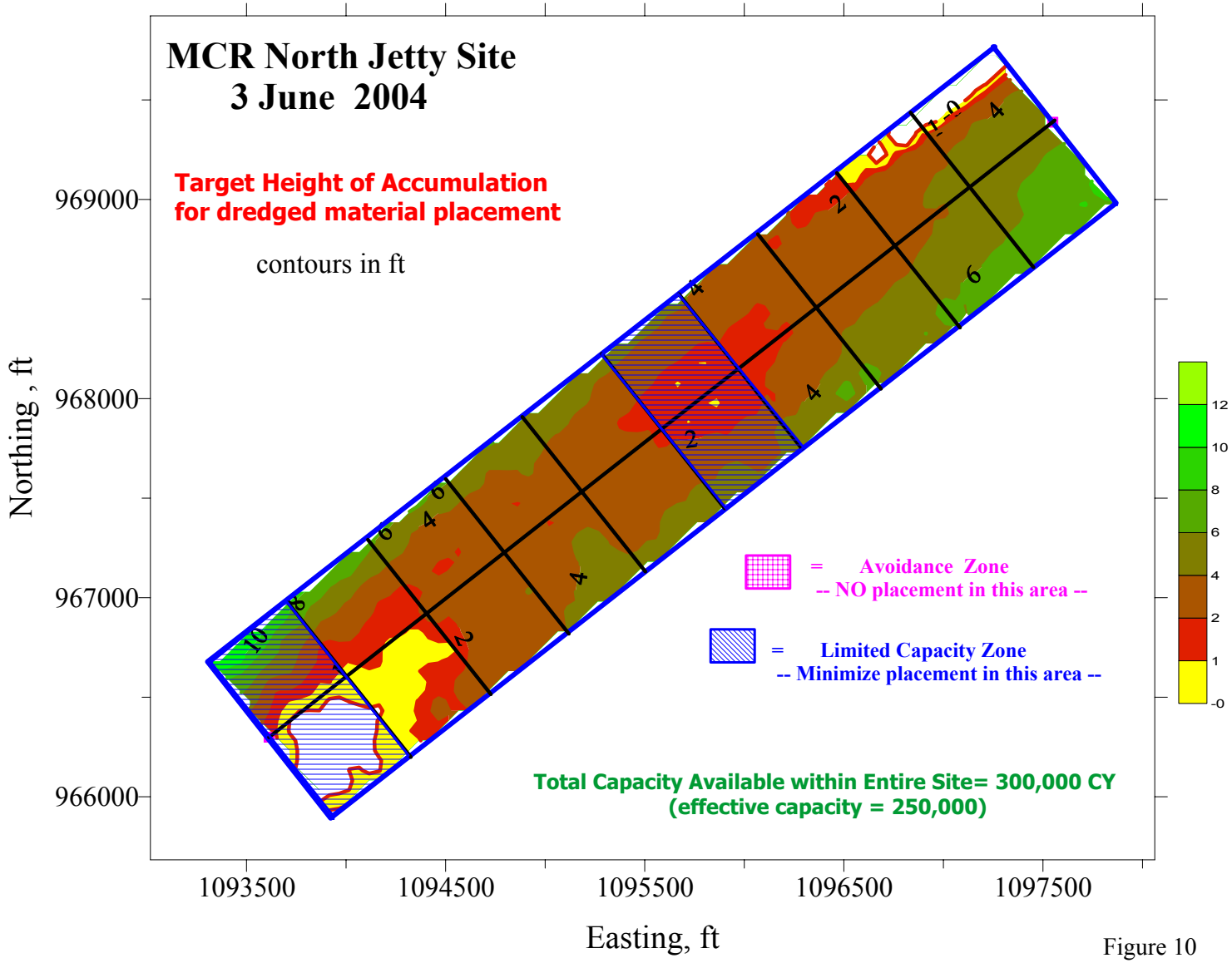

MCR North Jetty Site
3 June 2004
Target Height of Accumulation
for dredged material placement
contours in ft
= Avoidance Zone
-- NO placement in this area --
= Limited Capacity Zone
-- Minimize placement in this area --
Total Capacity Available within Entire Site= 300,000 CY
(effective capacity = 250,000)
Northing , ft
969000
968000
967000
966000
Easting, ft
1093500
1094500
1095500
1096500
1097500
12
10
8
6
4
2
1
-0

Figure 10

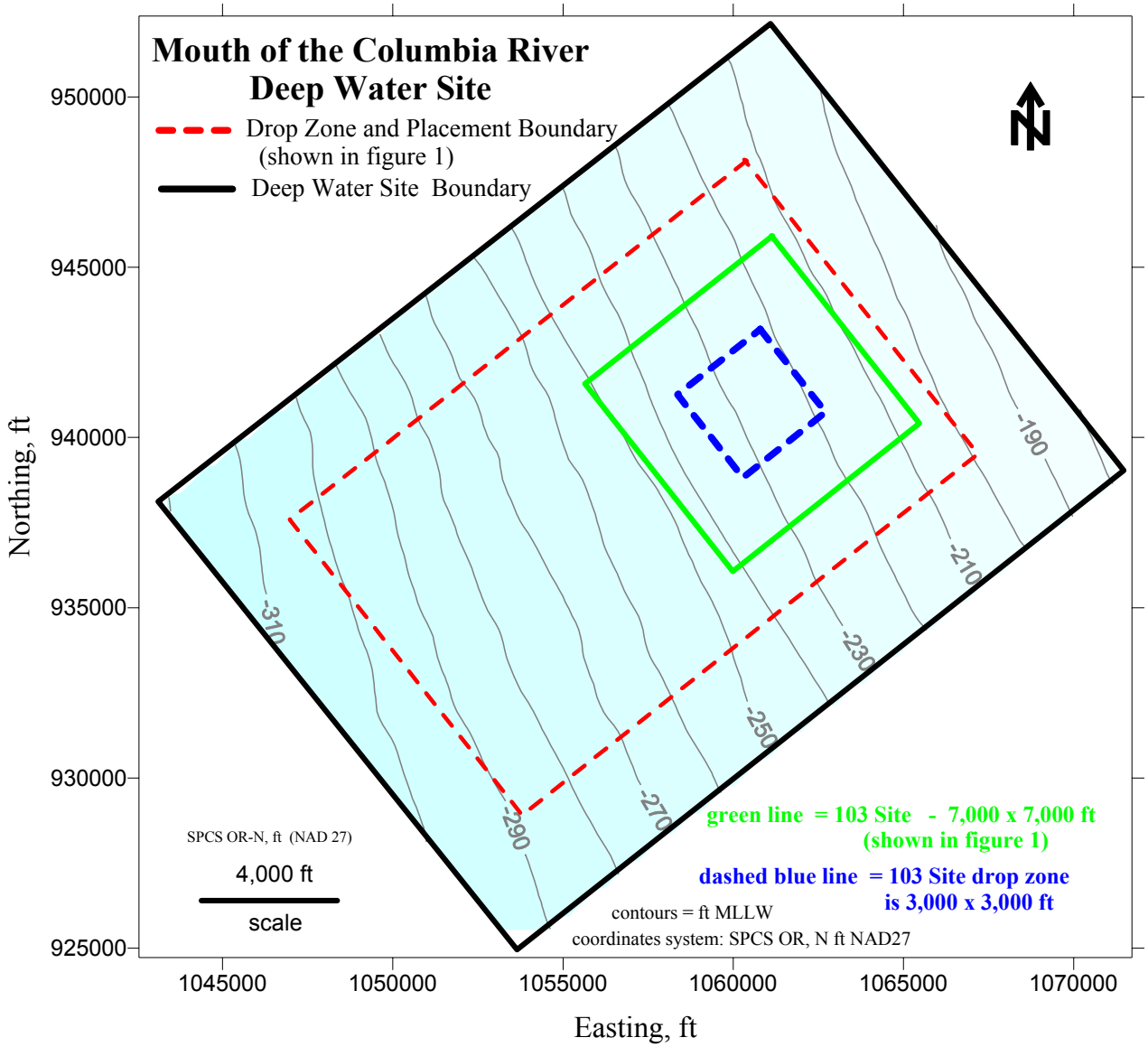
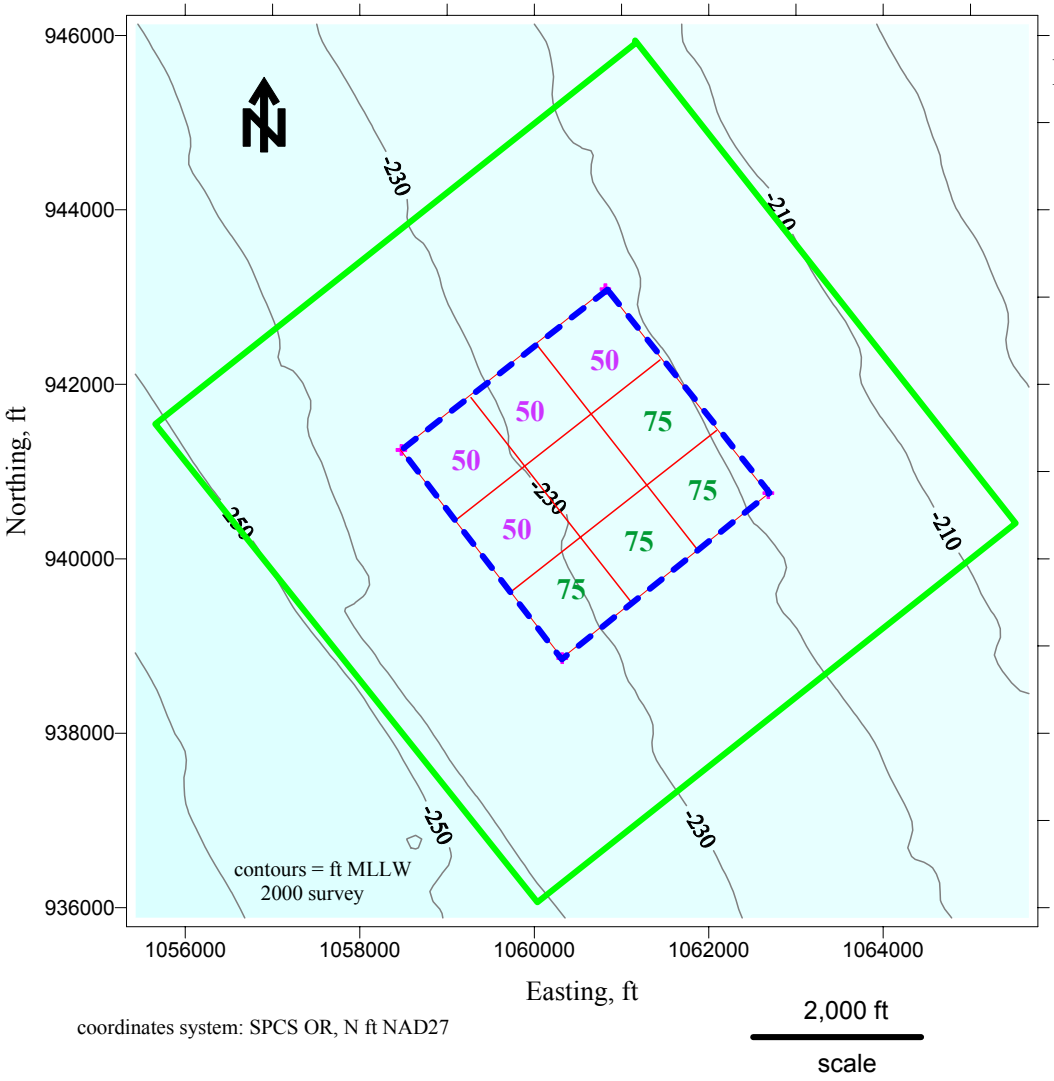

Mouth of the Columbia River
Deep Water Site
Drop Zone and Placement Boundary
(shown in figure 1)
Deep Water Site Boundary
N
-190
-210
-230
-250
-270
-290
-310
green line = 103 Site - 7,000 x 7,000 ft
(shown in figure 1)
dashed blue line = 103 Site drop zone
is 3,000 x 3,000 ft
contours = ft MLLW
coordinates system: SPCS OR, N ft NAD27
SPCS OR-N, ft (NAD 27)
4,000 ft
scale
Northing, ft
950000
945000
940000
935000
930000
925000
1045000
1050000
1055000
1060000
1065000
1070000
Easting, ft

Figure 11



Mouth of the Columbia River
Deep Water Site
Section 103 Area

Red Lines = grid (cells) used to control the placement of dredged material within the DWS 103 area - 1,000 x 1,000 ft ea.

Utilization Plan #1
for DWS-103: 2004

purple cell assignments = CONTRACT dredge loads/cell at 2,500 cy/load = 0.5 MCY

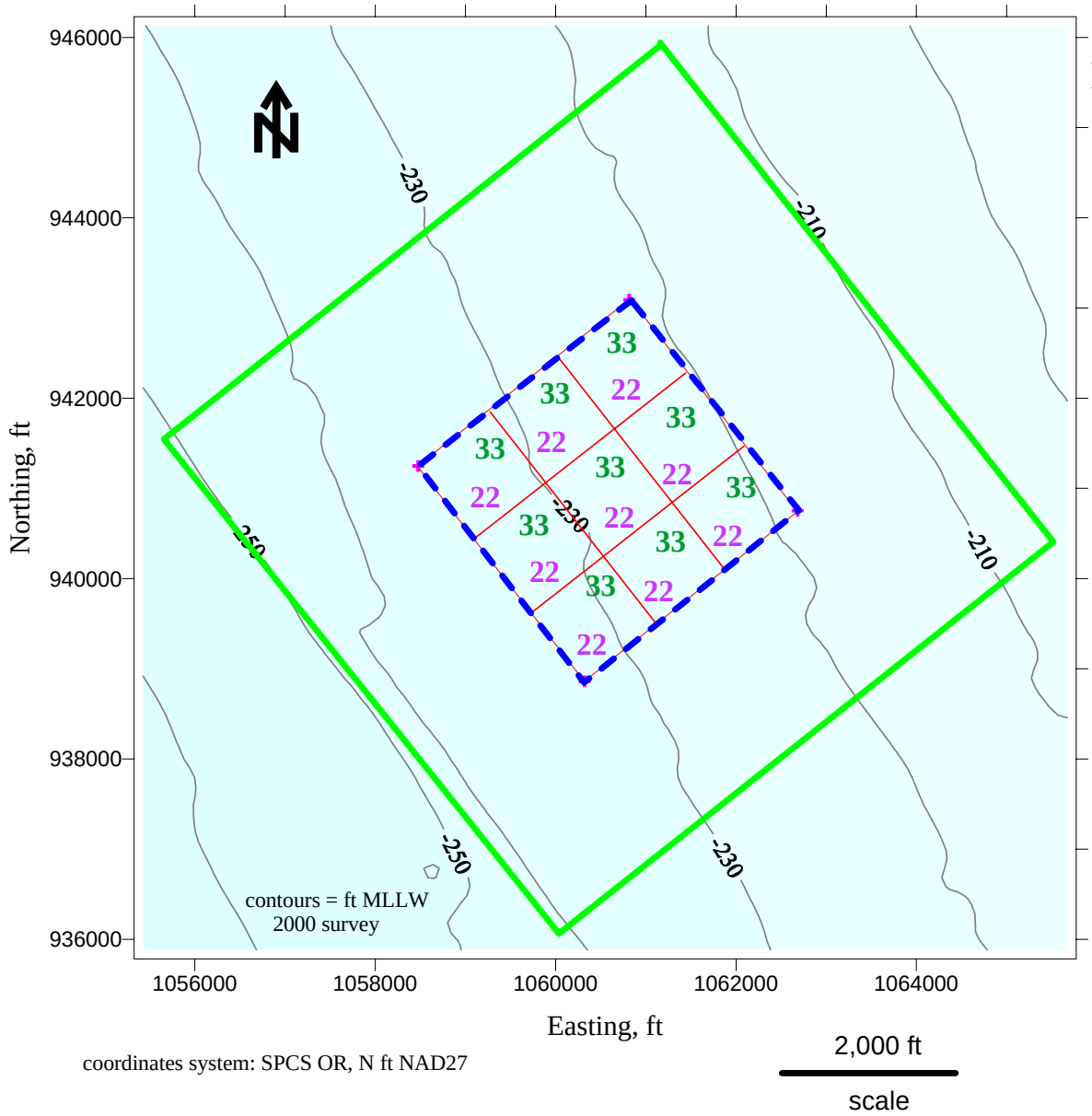
green cell assignments = GOVERNMENT dredge loads/cell at 5,000 cy/load = 1.5 MCY

dashed blue line = 103 Site drop zone is 3,000 x 3,000 ft

green line = 103 Site - 7,000 x 7,000 ft (shown in figure 1)

Figure 12

Due to safety concerns while disposing in the Deep Water Site, the disposal plan has been adjusted to allow for dumping within the entire 3000' x 3000' site. The original plan for the ESSAYONS allowed for disposal along cells DW-7, DW-8, DW-9, and DW-6. In order to dispose across these cells, the dredge would have to transit perpendicular to wave action. This would result in waves impacting the ship directly broadside while disposing of material. A dredge's stability is most vulnerable to waves during disposal operations. The maneuverability of the ship is limited. In addition, the problem is compounded due to the fact that the ESSAYONS will list to its port or starboard side while disposing of material. The situation of listing to one side and having a wave hit the other side of the ship is likely the most unsafe situation the dredge can be in. In order to avoid this situation, the dredges must have maximum flexibility to adjust to wave conditions



coordinates system: SPCS OR, N ft NAD27

Mouth of the Columbia River Deep Water Site Section 103 Area

Red Lines = grid (cells) used to control the placement of dredged material within the DWS 103 area - 1,000 x 1,000 ft ea.

Utilization Plan #2 for DWS-103: 2004

purple cell assignments = CONTRACT dredge loads/cell at 2,500 cy/load = 0.5 MCY

green cell assignments = GOVERNMENT dredge loads/cell at 5,000 cy/load = 1.5 MCY

dashed blue line = 103 Site drop zone is 3,000 x 3,000 ft

green line = 103 Site - 7,000 x 7,000 ft (shown in figure 1)

Figure 12